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Cognitive impairment following stroke: Protocol for a systematic review of non-randomised controlled studies of psychological interventions.

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Abstract

Introduction: Stroke is a primary cause of death and disability worldwide, leaving a considerable proportion of survivors with persistent cognitive and functional deficits. Despite the prevalence of post-stroke cognitive impairment, there is no established treatment aimed at improving cognitive function following a stroke. Therefore, the aims of this systematic review are to identify psychological interventions that have been employed to improve post-stroke cognitive function and establish their efficacy.

Methods and analysis: A systematic review of non-randomised controlled studies that investigated the efficacy of psychological interventions aimed at improving cognitive function in stroke survivors will be conducted. Electronic searches will be performed in the Pubmed, EMBASE, and PsycINFO databases. Reference lists of all identified relevant articles will be reviewed to identify additional studies that may not have been identified by the electronic search. A review of potential grey literature will take place using Google Scholar. Titles and abstracts will be assessed for eligibility by one reviewer, with a random sample of 50% independently double-screened by a second reviewer. Any discrepancies will be resolved through discussion, with referral to a third reviewer where necessary. Any risk of bias will be assessed with the ROBINS-I tool. Meta-analyses will be performed if studies are sufficiently homogeneous. This review will follow the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) statement. The quality of the evidence regarding cognitive function will be assessed according to the Grading of Recommendations Assessment, Development and Evaluation (GRADE).

Discussion: This systematic review will provide information on the effectiveness of psychological interventions for post-stroke cognitive impairment, identifying which psychological interventions are effective for improving post-stroke cognitive function. This evidence will be used alongside a Cochrane review of randomised trials of psychological interventions for post-stroke cognitive impairment to inform the development of a cognitive rehabilitation intervention.

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WC: 2,556

Keywords

Stroke; cognitive impairment; cognitive rehabilitation

Strengths and Limitations

- This systematic review protocol will be reported in accordance with the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) statement.
- Three databases covering the medical and psychological peer-reviewed literature will be searched.
- The quality of the evidence will be assessed based on the Grading of Recommendations Assessment, Development and Evaluation (GRADE).
- This systematic review will not include interventions based on pharmacological or non-psychological treatments, and will include stroke patients only.

Introduction

Stroke is one of the primary causes of death and disability worldwide (1), with a considerable proportion of those having a stroke developing significant persistent cognitive deficits which impact upon functional ability (2). Cognitive impairment has been reported in over half of patients six months post-stroke, and is associated with increased disability and a poorer quality of life (3), while cognitive impairment in the acute phase post-stroke is associated with depressive symptoms in the longer-term (4). Those with moderate post-stroke cognitive impairment are six times more likely to transition to incident dementia compared to those without cognitive impairment (5), with up to a quarter of patients with cognitive impairment diagnosed with dementia in the 3 years following stroke (6). Furthermore, it has been shown that 10% of patients develop dementia following a first ever stroke and over one third develop dementia following a recurrent stroke (7). As such, there is a strong association between cognitive impairment and nursing home admission, particularly in those individuals affected by a more severe stroke. While the recovery of physical function post-stroke has been the main focus of rehabilitation and research, with evidence demonstrating significant improvements following physical rehabilitation (8,9), rehabilitation of post-stroke cognitive impairment has received considerably less attention. Despite the prevalence of cognitive impairment post-stroke, and the associated implications for stroke survivors and burden on carers and the healthcare system, there are no established psychological interventions for the rehabilitation of cognitive impairment following stroke.

Cognitive rehabilitation has been defined as a "systematic, functionally oriented service of therapeutic activities that is based on assessment and understanding of the patient's brain-behavioural deficits" (10). Five previous Cochrane reviews have been conducted in the area of post-stroke cognitive rehabilitation. Specifically, these reviews have focused on occupational therapy for cognitive impairment (11), memory deficits (12), executive dysfunction (13), spatial neglect (14), and attention deficits (15) following stroke. Each has concluded that the effectiveness of cognitive rehabilitation aimed at each of these domains separately has yet to be established. However, the stringent nature of eligibility criteria for inclusion in these reviews could have resulted in the exclusion of important non-randomised controlled studies. The pattern of post-stroke cognitive impairment suggests that deficits may be evident across all cognitive domains rather than being confined to one cognitive domain (16,17), with lesion location predicting the severity of cognitive impairment across different cognitive domains following stroke (18,19). Despite the evidence suggesting more diffuse cognitive impairment

post-stroke rather than domain-specific deficits, there is, as yet, no review of psychological interventions for post-stroke cognitive impairment that includes the full range of psychological interventions and which targets all forms of cognitive impairment (e.g., including memory, attention, executive function, etc.). While a Cochrane review of randomised controlled trials of psychological interventions for post-stroke cognitive impairment is now planned by our group (20), this current review aims to capture those non-randomised controlled studies which do not meet the strict inclusion criteria of a Cochrane review but may be of value when designing a cognitive rehabilitation programme for post-stroke cognitive impairment.

Therefore the aims of the present systematic review are to identify which types of (non-randomised) psychological interventions have been employed to improve cognitive function post-stroke and to assess the efficacy of these interventions in stroke survivors. The overarching goal is to inform the development of a cognitive rehabilitation intervention for individuals who experience cognitive impairment following stroke.

Methods and Analyses

Study Design

This systematic review protocol will be reported in accordance with the Preferred Reporting Items for Systematic review and Meta-analysis Protocols (PRISMA-P) (21,22). Results will be reported in line with the Preferred Reporting Items for Systematic review and Meta-analysis (PRISMA) statement (23,24).

Study Registration

In accordance with the PRISMA-P guidelines, this systematic review protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO) on 30 June 2017 (registration number: CRD42017069714; http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42017069714)

Eligibility Criteria

Types of study

All non-randomised controlled studies and quasi-randomised controlled trials examining psychological interventions to improve cognitive function following stroke will be included in this systematic review, including feasibility studies, pilot studies, ,experimental studies, and quasi-experimental studies. RCTs, review articles, letters, editorials, qualitative studies, case studies, animal studies and study protocols will be excluded.

Participants

Studies of an adult population (age 18+) will be included. Studies of participants with mixed aetiologies (e.g., traumatic brain injury/stroke mix) will be excluded unless data are available, or made available upon contacting the study authors, for those participants with a primary diagnosis of stroke (ischaemic, intracranial haemorrhagic, subarachnoid haemorrhage) or if the study has more than 75% of people with stroke in their sample (15).

Types of interventions

Given the wide variation in types of interventions to address post-stroke cognitive impairment, psychological interventions of any type intended to rehabilitate cognition post-stroke will be included. Examples of the eligible interventions will include: neuropsychological interventions;

patient education interventions (video, books, leaflets, posters, videos, interactive modules); electronic interventions (e.g., use of iPads, tablets); mobile phone apps, including brain training apps/games; cognitive and/or behavioural interventions, including problem-solving; strategy training; goal management training; self-efficacy training. Studies with pharmacological or other non-psychological interventions will be excluded.

Comparisons or control

Studies addressing psychological interventions to improve cognition following stroke in comparison to a usual/routine care control arm will be included.

Outcome measures

The outcome of interest is improved cognition after stroke, using a validated measure of cognitive assessment, including any of the following: Montreal Cognitive Assessment (MoCA) (25); Mini-Mental State Examination (MMSE) (26); Abbreviated Mental Test (AMT) (27); or the NINDS 30-minute or 60-minute battery of cognitive assessment (28). Other validated measures are also acceptable, as are validated measures of subjective cognitive function (e.g. Cognitive Failures Questionnaire (29); Metamemory in Adulthood Questionnaire (30)) and Goal Attainment Scaling (31).

Secondary outcomes of interest include reports of functional abilities in daily life and quality of life, including activities of daily living (ADL), for example using the modified Rankin Scale (mRS) (32); Instrumental activities of daily living (IADL), for example using the Nottingham Extended Activities of Daily Living (NEADL) scale (33); Quality of life (QoL), based on stroke-specific or generic QoL assessment measures; subsequent incidence of recurrent stroke, dementia, cardiovascular events, or all-cause mortality.

Search strategy for the identification of relevant studies

The search strategy has been developed in collaboration with a subject librarian. Three databases covering the medical and psychological peer-reviewed literature will be searched: Pubmed (http://www.ncbi.nlm.nih.gov/pubmed/), EMBASE (https://www.embase.com) and PsycINFO (http://www.apa.org/pubs/databases/psycinfo/index.aspx). The Pubmed search strategy is detailed in Appendix 1. These terms will also be mapped to Medical Subject Headings (MeSH) terms, and similar terms in EMBASE and PsycINFO. The search will be restricted to articles published in English.

Searches will be exported to EndNote X7™ to build a master file of all references. In addition to the database searches, the reference list of included articles will be reviewed for relevant studies. A citation search will also be carried out to identify papers citing included articles, using Web of Science. A hand-search will also be conducted of the four journals that generate the greatest number of relevant articles.

Screening of the Studies

Duplicates will be identified using EndNote X7™ 'find duplicates' function. Titles and abstracts will be assessed for eligibility by one reviewer (NAM). Depending on the volume of papers generated by the search, at least a random 50% will be independently double-screened between four second reviewers (MEW, IJ, AG, DR). The full texts of papers identified as potentially eligible will be obtained for independent review by two reviewers. Any differences between reviewers will be resolved through discussion, with reference to a third independent reviewer (AH) where necessary.

Data Extraction

Data from included studies will be extracted using a standardised, pre-piloted data extraction form. Two reviewers will extract data independently, with discrepancies identified and resolved through discussion, including with a third author where necessary. Extracted information will include: authors, study design, sample size (baseline and follow-up), sample description, target population characteristics, intervention type, intervention content, control (placebo, no treatment), length of follow-up, type of outcome, primary and secondary outcomes (listed above), comments, and study conclusions. Study authors will be contacted for missing data or further information if necessary.

Risk of bias

Two authors will assess the strengths and weaknesses of each eligible study using the Risk Of Bias In Non-randomized Studies - of Interventions (ROBINS-I) tool by the Cochrane Collaboration (34).

No study will be excluded as a result of findings from the risk of bias assessments. However, if substantial variation in risk of bias of included studies is found, results will be synthesised separately for studies at high risk and low risk of bias.

Quality of evidence

The quality of the evidence of the studies will be assessed by two reviewers (NAM and MEW) based on the Grading of Recommendations Assessment, Development and Evaluation (GRADE) (35). The quality of the studies will be judged as high (further research is very unlikely to change the confidence in the effect estimates), moderate (further research is likely to have an important impact on the confidence in the effect and may change the estimate), low (further research is very likely to have an important impact on the confidence in the effect and is likely to change the estimate) and very low (any estimate of the effect is very uncertain) (35)

Strategy for data synthesis

Meta-analysis will be conducted provided that the studies/methods are sufficiently homogeneous regarding the interventions and outcomes and, if sufficient data are available, to synthesise the direction, size and consistency of the possible effects, using Stata version 14. If meta-analysis is not possible due to substantial heterogeneity, etc., a narrative synthesis of the findings from the included studies will be provided, structured around the type of intervention, target population characteristics, type of outcome and intervention content. Heterogeneity will be quantified using the I-squared statistic.

Analyses of subgroup or subsets

If sufficient data are available, subgroup analyses will be conducted. These analyses will assess differences between age of participants with stroke (<65 versus >=65); objective versus subjective improvement in cognition; type of intervention (e.g., self-efficacy training versus education versus electronic; brief versus intensive; group versus individual; brief health care professional (HCP) contact versus longer-term HCP contact, etc.), duration, and delivery of intervention, timing of outcome measures (e.g., direct versus late effects of the intervention); quality and risk of bias.

Discussion

To the best of our knowledge, this review will be the first to investigate non-randomised controlled studies of the effectiveness of psychological interventions aimed at improving general cognitive function post-stroke. Previous reviews have examined domain-specific interventions and outcomes such as attention, memory, executive function, and spatial neglect, with each review concluding that effectiveness of cognitive rehabilitation aimed at each of these domains separately has yet to be established (12–15). However the pattern of post-stroke cognitive impairment typically is diffuse in nature, affecting a number of cognitive domains (16,17). Furthermore, due to the stringent eligibility criteria of previous reviews important studies may not have been included. These factors may limit the interpretation of the findings regarding the impact of interventions aimed at improving cognitive function in stroke survivors. Considering that cognitive impairment is a risk factor for progression to dementia, particularly in the context of further stroke (7), it is important to investigate the effectiveness of different types of psychological interventions to improve cognitive function in those with post-stroke cognitive impairment.

The results of this review will provide evidence regarding which types, duration, and delivery of psychological interventions are effective for managing post-stroke cognitive impairment, and will, in turn, inform the development of a cognitive rehabilitation programme as part of a wider study, the StrokeCog study (36), aimed at improving cognitive function post-stroke. Furthermore, if sufficiently homogenous data are available to conduct a meta-analysis, healthcare professionals will have information available regarding the expected effect size associated with a given intervention. This information will be useful for planning of rehabilitation services for those with post-stroke cognitive impairment. The results from this systematic review will be disseminated by scientific publication and presentations at scientific events.

Contributors

NAM, ES, ND, GMC, NP, DR, IJ, AG, MEW, DW, FD, FH, MW, KEB, and AH contributed to the conception and design of the study, the development of the search strategy, the establishment of the inclusion and exclusion criteria, data extraction criteria, analyses and interpretation. NAM, DR, IJ, AG, and MEW will perform the study search, screening and extraction of data. NAM drafted the manuscript, and AH, KEB, DW, NP, FH, and FD provided critical revision of the paper. All authors read and approved the final manuscript.

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Competing interests

None declared.

Protocol amendments

Protocol amendments will be documented with the date of each amendment and with a description of the change and the rationale.

Data sharing statement

We, authors, agree that, should the article be accepted, the BMJ Open shall take over the authors' rights relating to this article, which shall become the property of the Journal.

References

1. Feigin VL, Norrving B, Mensah GA. Global burden of stroke. Circ Res. 2017;120(3):439–48.

2. Tatemichi TK, Desmond DW, Stern Y, Paik M, Sano M, Bagiella E. Cognitive impairment after stroke: Frequency, patterns, and relationship to functional abilities. J Neurol Neurosurg Psychiatry [Internet]. 1994;57(2):202–7. Available from: http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=8126506

3. Mellon L, Brewer L, Hall P, Horgan F, Williams D, Hickey A. Cognitive impairment six months after ischaemic stroke: A profile from the ASPIRE-S study. BMC Neurol [Internet]. 2015;15(31):1–9. Available from: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4359388&tool=pmcentrez&rendertype=abstract

4. Nys GMS, van Zandvoort MJE, van der Worp HB, de Haan EHF, de Kort PLM, Jansen BPW, et al. Early cognitive impairment predicts long-term depressive symptoms and quality of life after stroke. J Neurol Sci. 2006;247(2):149–56.

5. Narasimhalu K, Ang S, De Silva DA, Wong M-C, Chang H-M, Chia K-S, et al. Severity of CIND and MCI predict incidence of dementia in an ischemic stroke cohort. Neurology. 2009;73(22):1866–72.

6. Sachdev PS, Chen X, Brodaty H, Thompson C, Altendorf A, Wen W. The determinants and longitudinal course of post-stroke mild cognitive impairment. J Int Neuropsychol Soc [Internet]. 2009;15(6):915–23. Available from: http://www.ncbi.nlm.nih.gov/pubmed/19891821

7. Pendlebury ST, Rothwell PM. Prevalence, incidence, and factors associated with pre-stroke and post-stroke dementia: A systematic review and meta-analysis. Lancet Neurol [Internet]. 2009;8(11):1006–18. Available from: http://dx.doi.org/10.1016/S1474-4422(09)70236-4

8. Horgan F, Hickey A, McGee H, O'Neill D. National Audit of Stroke Care [Internet]. Dublin, Ireland; 2008. Available from: http://epubs.rcsi.ie/psycholrep/17/

9. Saka Ö, McGuire A, Wolfe C. Cost of stroke in the United Kingdom. Age Ageing. 2009;38(1):27–32.

10. Cicerone KD, Dahlberg C, Malec JF, Langenbahn DM, Felicetti T, Kneipp S, et al. Evidence-based cognitive rehabilitation: Updated review of the literature from 1998 through 2002. Arch Phys Med Rehabil. 2005;86(8):1681–92.

11. Hoffmann T, Bennett S, Koh C-L, McKenna KT. Occupational therapy for cognitive impairment in stroke patients. Cochrane Database Syst Rev. 2010;(9):CD006430.

12. das Nair R, Cogger H, Worthington E, Lincoln NB. Cognitive rehabilitation for memory deficits following stroke. Cochrane Database Syst Rev. 2016;9:CD002293.

13. Chung CSY, Pollock A, Campbell T, Durward BR, Hagen S. Cognitive rehabilitation for executive dysfunction in patients with stroke or other adult non-progressive acquired brain damage. Cochrane Database Syst Rev. 2013;(4):CD008391.

14. Bowen A, Hazelton C, Pollock A, Lincoln NB. Cognitive rehabilitation for spatial neglect following stroke. Cochrane Database Syst Rev [Internet]. 2013;(7):CD003586. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23813503

15. Loetscher T, Lincoln NB. Cognitive rehabilitation for attention deficits following stroke. Cochrane Database Syst Rev [Internet]. 2013;(5):CD002842. Available from: http://onlinelibrary.wiley.com/store/10.1002/14651858.CD002842.pub2/asset/CD002842.pdf?v=1&t=icp2f4j9&s=4202599389d6199b9e52dc776db5c2a03c617ecd

16. Sachdev PS, Brodaty H, Valenzuela MJ, Lorentz L, Looi JCL, Wen W, et al. The neuropsychological profile of vascular cognitive impairment in stroke and TIA patients. Neurology. 2004;62:912–9.

17. Vasquez BP, Zakzanis KK. The neuropsychological profile of vascular cognitive impairment not demented: A meta-analysis. J Neuropsychol. 2015;9(1):109–36.

18. Barker-Collo S, Starkey N, Lawes CMM, Feigin V, Senior H, Parag V. Neuropsychological profiles of 5-year ischemic stroke survivors by oxfordshire stroke classification and hemisphere of lesion. Stroke. 2012;43(1):50–5.

19. Nys GMS, Van Zandvoort MJE, De Kort PLM, Jansen BPW, Van Der Worp HB, Kappelle LJ, et al. Domain-specific cognitive recovery after first-ever stroke: A follow-up study of

111 cases. J Int Neuropsychol Soc [Internet]. 2005;11(7):795–806. Available from: http://www.researchgate.net/publication/7259366_Domain-specific_cognitive_recovery_after_first-ever_stroke_A_follow-up_study_of_111_cases

20. Hickey A, Merriman NA, McCabe G, Mellon L, Bennett KE, Pender N, et al. Psychological interventions for managing cognitive impairment after ischaemic stroke [Internet]. Available from: http://www.cochrane.org/title/psychological-interventions-managing-cognitive-impairment-after-ischaemic-stroke

21. Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. Syst Rev [Internet]. 2015;4(1):1. Available from: http://systematicreviewsjournal.biomedcentral.com/articles/10.1186/2046-4053-4-1

22. Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. Syst Rev [Internet]. 2016;354:i4086. Available from: http://systematicreviewsjournal.biomedcentral.com/articles/10.1186/2046-4053-4-1

23. Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. Annu Intern Med. 2009;151(4):264–9.

24. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, Ioannidis JPA, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. PLoS Med. 2009;6(7):e1000100.

25. Nasreddine ZS, Phillips NA, Bédirian V, Charbonneau S, Whitehead V, Collin I, et al. The Montreal Cognitive Assessment, MoCA: a brief screening tool for mild cognitive impairment. J Am Geriatr Soc [Internet]. 2005 [cited 2013 Jun 25];53(4):695–9. Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1532-5415.2005.53221.x/full

26. Folstein MF, Folstein SE, McHugh PR. Mini-Mental State: A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res. 1975;12(3):189–98.

27. Hodkinson HM. Evaluation of a mental test score for assessment of mental impairment in the elderly. Age Ageing. 1972;1:233–8.

28. Hachinski V, Iadecola C, Petersen RC, Breteler MM, Nyenhuis DL, Black SE, et al. National Institute of Neurological Disorders and Stroke-Canadian Stroke Network vascular cognitive impairment harmonization standards. Stroke. 2006;37(9):2220–41.

29. Broadbent DE, Cooper PF, FitzGerald P, Parkes KR. The Cognitive Failures Questionnaire (CFQ) and its correlates. Br J Clin Psychol [Internet]. 1982;21(1):1–16. Available from: http://doi.wiley.com/10.1111/j.2044-8260.1982.tb01421.x

30. Dixon RA, Hultsch DF, Hertzog C. The Metamemory in Adulthood (MIA) questionnaire. Psychopharmacol Bull [Internet]. 1989;25(2):157. Available from: www-ncbi-nlm-nih-gov.elib.tcd.ie/pubmed/3249770

31. Kiresuk TJ, Sherman RE. Goal attainment scaling: A general method for evaluating comprehensive community mental health programs. Community Ment Health J. 1968;4(6):443–53.

32. Sulter G, Steen C, De Keyser J. Use of the Barthel index and modified Rankin scale in acute stroke trials. Stroke. 1999;30:1538–41.

33. Nouri FM, Lincoln NB. An extended activities of daily living scale for stroke patients. Clin Rehabil. 1987;1(4):301–5.

34. Sterne JAC, Hernán MA, Reeves BC, Savović J, Berkman ND, Viswanathan M, et al. ROBINS-I: a tool for assessing risk of bias in non-randomized studies of interventions. BMJ. 2016;355:i4919.

35. Guyatt GH, Oxman AD, Vist GE, Kunz R, Falck-Ytter Y, Alonso-Coello P, et al. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. Br Med J. 2008;336(April):924–6.

36. The StrokeCog study: modelling and modifying the consequences of stroke-related cognitive impairment through intervention [Internet]. Available from: http://www.hrb.ie/research-strategy-funding/grants-and-fellowships/funding-awarded/funding-award/awards//639/

Appendix 1: Pubmed search strategy

((((stroke[MeSH] OR intracranial embolism and thrombosis[MeSH] OR intracranial arteriosclerosis[MeSH] OR dementia, vascular[MeSH] OR cerebrovascular disorders[MeSH:noexp] OR basal ganglia cerebrovascular disease[MeSH] OR brain ischemia[MeSH] OR carotid artery diseases[MeSH] OR cerebral small vessel disease[MeSH] OR brain injuries[MeSH]) OR (stroke[Title/Abstract] OR cerebrovascular[Title/Abstract] OR post stroke[Title/Abstract] OR poststroke[Title/Abstract] OR cerebral ischaemia*[Title/Abstract] OR cerebral ischemia*[Title/Abstract] OR brain ischaemia*[Title/Abstract] OR brain ischemia*[Title/Abstract] OR ischemic attack*[Title/Abstract] OR ischaemic attack*[Title/Abstract] OR ischemic event*[Title/Abstract] OR ischaemic event*[Title/Abstract] OR cerebral infarct*[Title/Abstract] OR brain infarct*[Title/Abstract] OR cva[Title/Abstract] OR cerebral vascular[Title/Abstract] OR brain injur*[Title/Abstract]) OR ((cerebral[Title/Abstract] OR cerebellar[Title/Abstract] OR brain*[Title/Abstract] OR vertebrobasilar[Title/Abstract]) AND (infarct*[Title/Abstract] OR ischemi*[Title/Abstract] OR ischaemi*[Title/Abstract] OR thrombo*[Title/Abstract] OR emboli*[Title/Abstract] OR apoplexy[Title/Abstract]))) AND ((cognition disorders[MeSH:noexp] OR neurobehavioral manifestations[MeSH:noexp] OR confusion[MeSH:noexp] OR memory disorders[MeSH:noexp] OR mental processes[MeSH:noexp] OR cognition[MeSH:noexp] OR comprehension[MeSH:noexp] OR learning[MeSH:noexp] OR generalization psychology[MeSH:noexp] OR transfer psychology[MeSH:noexp] OR perception[MeSH:noexp] OR thinking[MeSH:noexp] OR concept formation[MeSH:noexp] OR judgment[MeSH:noexp] OR problem solving[MeSH:noexp] OR perceptual disorders[MeSH:noexp] OR arousal[MeSH:noexp] OR orientation[MeSH:noexp] OR attention[MeSH:noexp] OR awareness[MeSH:noexp] OR memory[MeSH:noexp] OR recognition psychology[MeSH:noexp] OR algorithms[MeSH:noexp] OR impulsive behavior[MeSH:noexp] OR neuropsychological tests[MeSH:noexp] OR metacognition[MeSH:noexp]) OR (agnosia[Title/Abstract] OR amnesia[Title/Abstract] OR confusion[Title/Abstract] OR inattention[Title/Abstract]) OR ((cognit*[Title/Abstract] OR arous*[Title/Abstract] OR orientat*[Title/Abstract] OR attention*[Title/Abstract] OR concentrat*[Title/Abstract] OR memor*[Title/Abstract] OR recall[Title/Abstract] OR percept*[Title/Abstract] OR think*[Title/Abstract] OR sequenc*[Title/Abstract] OR algorithm*[Title/Abstract] OR judgement*[Title/Abstract] OR judgment*[Title/Abstract] OR awareness[Title/Abstract] OR problem solving[Title/Abstract] OR generalisation[Title/Abstract] OR generalization[Title/Abstract] OR transfer[Title/Abstract] OR comprehension[Title/Abstract] OR learning[Title/Abstract]) AND (disorder*[Title/Abstract] OR declin*[Title/Abstract] OR dysfunct*[Title/Abstract] OR impair*[Title/Abstract] OR deficit*[Title/Abstract] OR abilit*[Title/Abstract] OR problem*[Title/Abstract])) OR (concept[Title/Abstract] AND formation[Title/Abstract]) OR (dysexecutive syndrome*[Title/Abstract] OR dysexecutive function[Title/Abstract] OR mental process*[Title/Abstract] OR impulsive behavior*[Title/Abstract] OR impulsive behaviour*[Title/Abstract] OR executive function[Title/Abstract] OR executive dysfunction[Title/Abstract] OR front striatal dysfunction[Title/Abstract]))) AND ((Rehabilitation[MeSH] OR games, experimental[MeSH] OR Computer-Assisted Instruction[MeSH]) OR (cognitive intervention*[Title/Abstract] OR cognitive training[Title/Abstract] OR cognitive rehabilitation[Title/Abstract] OR cognitive

stimulation[Title/Abstract] OR psychological intervention*[Title/Abstract] OR psychological rehabilitation[Title/Abstract] OR psychological training[Title/Abstract] OR cognitive program*[Title/Abstract] OR psychological program*[Title/Abstract] OR training program*[Title/Abstract] OR neuropsychologic*[Title/Abstract] OR computer* AND training[Title/Abstract] OR video game*[Title/Abstract] OR computer game*[Title/Abstract] OR brain training[Title/Abstract] OR memory training[Title/Abstract] OR mnemonic training[Title/Abstract] OR cognitive remediation[Title/Abstract] OR cognitive enhancement[Title/Abstract] OR neurological outcome measure*[Title/Abstract] OR Goal Attainment Scaling[Title/Abstract] OR mental practice[Title/Abstract] OR mental imagery[Title/Abstract] OR visual scanning training[Title/Abstract] OR compensat*[Title/Abstract])))) NOT (((((stroke[MeSH] OR intracranial embolism and thrombosis[MeSH] OR intracranial arteriosclerosis[MeSH] OR dementia, vascular[MeSH] OR cerebrovascular disorders[MeSH:noexp] OR basal ganglia cerebrovascular disease[MeSH] OR brain ischemia[MeSH] OR carotid artery diseases[MeSH] OR cerebral small vessel disease[MeSH] OR brain injuries[MeSH]) OR (stroke[Title/Abstract] OR cerebrovascular[Title/Abstract] OR post stroke[Title/Abstract] OR poststroke[Title/Abstract] OR cerebral ischaemia*[Title/Abstract] OR cerebral ischemia*[Title/Abstract] OR brain ischaemia*[Title/Abstract] OR brain ischemia*[Title/Abstract] OR ischemic attack*[Title/Abstract] OR ischaemic attack*[Title/Abstract] OR ischemic event*[Title/Abstract] OR ischaemic event*[Title/Abstract] OR cerebral infarct*[Title/Abstract] OR brain infarct*[Title/Abstract] OR cva[Title/Abstract] OR cerebral vascular[Title/Abstract] OR brain injur*[Title/Abstract]) OR ((cerebral[Title/Abstract] OR cerebellar[Title/Abstract] OR brain*[Title/Abstract] OR vertebrobasilar[Title/Abstract]) AND (infarct*[Title/Abstract] OR ischemi*[Title/Abstract] OR ischaemi*[Title/Abstract] OR thrombo*[Title/Abstract] OR emboli*[Title/Abstract] OR apoplexy[Title/Abstract])))) AND ((cognition disorders[MeSH:noexp] OR neurobehavioral manifestations[MeSH:noexp] OR confusion[MeSH:noexp] OR memory disorders[MeSH:noexp] OR mental processes[MeSH:noexp] OR cognition[MeSH:noexp] OR comprehension[MeSH:noexp] OR learning[MeSH:noexp] OR generalization psychology[MeSH:noexp] OR transfer psychology[MeSH:noexp] OR perception[MeSH:noexp] OR thinking[MeSH:noexp] OR concept formation[MeSH:noexp] OR judgment[MeSH:noexp] OR problem solving[MeSH:noexp] OR perceptual disorders[MeSH:noexp] OR arousal[MeSH:noexp] OR orientation[MeSH:noexp] OR attention[MeSH:noexp] OR awareness[MeSH:noexp] OR memory[MeSH:noexp] OR recognition psychology[MeSH:noexp] OR algorithms[MeSH:noexp] OR impulsive behavior[MeSH:noexp] OR neuropsychological tests[MeSH:noexp] OR metacognition[MeSH:noexp]) OR (agnosia[Title/Abstract] OR amnesia[Title/Abstract] OR confusion[Title/Abstract] OR inattention[Title/Abstract]) OR ((cognit*[Title/Abstract] OR arous*[Title/Abstract] OR orientat*[Title/Abstract] OR attention*[Title/Abstract] OR concentrat*[Title/Abstract] OR memor*[Title/Abstract] OR recall[Title/Abstract] OR percept*[Title/Abstract] OR think*[Title/Abstract] OR sequenc*[Title/Abstract] OR algorithm*[Title/Abstract] OR judgement*[Title/Abstract] OR judgment*[Title/Abstract] OR awareness[Title/Abstract] OR problem solving[Title/Abstract] OR generalisation[Title/Abstract] OR generalization[Title/Abstract] OR transfer[Title/Abstract] OR comprehension[Title/Abstract] OR learning[Title/Abstract]) AND (disorder*[Title/Abstract] OR declin*[Title/Abstract] OR dysfunct*[Title/Abstract] OR impair*[Title/Abstract] OR deficit*[Title/Abstract] OR

abilit*[Title/Abstract] OR problem*[Title/Abstract])) OR (concept[Title/Abstract] AND formation[Title/Abstract]) OR (dysexecutive syndrome*[Title/Abstract] OR dysexecutive function[Title/Abstract] OR mental process*[Title/Abstract] OR impulsive behavior*[Title/Abstract] OR impulsive behaviour*[Title/Abstract] OR executive function[Title/Abstract] OR executive dysfunction[Title/Abstract] OR front striatal dysfunction[Title/Abstract]))) AND ((Rehabilitation[MeSH] OR games, experimental[MeSH] OR Computer-Assisted Instruction[MeSH]) OR (cognitive intervention*[Title/Abstract] OR cognitive training[Title/Abstract] OR cognitive rehabilitation[Title/Abstract] OR cognitive stimulation[Title/Abstract] OR psychological intervention*[Title/Abstract] OR psychological rehabilitation[Title/Abstract] OR psychological training[Title/Abstract] OR cognitive program*[Title/Abstract] OR psychological program*[Title/Abstract] OR training program*[Title/Abstract] OR neuropsychologic*[Title/Abstract] OR computer* AND training[Title/Abstract] OR video game*[Title/Abstract] OR computer game*[Title/Abstract] OR brain training[Title/Abstract] OR memory training[Title/Abstract] OR mnemonic training[Title/Abstract] OR cognitive remediation[Title/Abstract] OR cognitive enhancement[Title/Abstract] OR neurological outcome measure*[Title/Abstract] OR Goal Attainment Scaling[Title/Abstract] OR mental practice[Title/Abstract] OR mental imagery[Title/Abstract] OR visual scanning training[Title/Abstract] OR compensat*[Title/Abstract]))) AND (randomized controlled trial[Publication Type] OR controlled clinical trial[Publication Type] OR randomized[Title/Abstract] OR randomised[Title/Abstract] OR placebo[Title/Abstract] OR clinical trials as topic[MeSH:noexp] OR randomly[Title/Abstract] OR trial[Title]))

Cognitive impairment following stroke: Protocol for a systematic review of non-randomised controlled studies of psychological interventions.

PRISMA-P 2015 Checklist: recommended items to include in a systematic review protocol

Section and topic	Item Number	Checklist item	Page number(s)
ADMINISTRATIVE INFORMATION			
Title: Cognitive impairment following stroke: Protocol for a systematic review of non-randomised controlled studies of psychological interventions.			
Identification	1a	Identify the report as a protocol of a systematic review	1
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	Not an update
Registration	2	If registered, provide the name of the register (such as PROSPERO) and registration number	2
Authors:			
Contact	3a	Provide name, institutional affiliation, email address of all protocol authors; provide physical mailing address of corresponding author	1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	11
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	Not an amendment
Support:			
Sources	5a	Indicate sources of financial or other support for the review	11
Sponsor	5b	Provide name for the review funder and/or sponsor	11
Role of sponsor or funder	5c	Describe role of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	11
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	5
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	5

Cognitive impairment following stroke: Protocol for a systematic review of non-randomised controlled studies of psychological interventions.

METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	6-7
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trials registers or other grey literature sources) with planned dates of coverage	7
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated.	Appendix 1
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	8
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis	8
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	8
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding source), any pre-planned data assumptions and simplifications	6-7
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	7
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level., or both; state how this information will be used in data synthesis	8

Cognitive impairment following stroke: Protocol for a systematic review of non-randomised controlled studies of psychological interventions.

Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	9
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I2, Kendall's)	9
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	9
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	9
Met-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	8
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assesses (such as GRADE)	9

BMJ Open

Managing cognitive impairment following stroke: Protocol for a systematic review of non-randomised controlled studies of psychological interventions.

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Primary Subject Heading:	Public health
Secondary Subject Heading:	Rehabilitation medicine
Keywords:	Stroke < NEUROLOGY, Cognitive Impairment, Cognitive Rehabilitation

Managing cognitive impairment following stroke: Protocol for a systematic review of non-randomised controlled studies of psychological interventions.

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Abstract

Introduction: Stroke is one of the primary causes of death and disability worldwide, leaving a considerable proportion of survivors with persistent cognitive and functional deficits. Despite the prevalence of post-stroke cognitive impairment, there is no established treatment aimed at improving cognitive function following a stroke. Therefore, the aims of this systematic review are to identify psychological interventions intended to improve post-stroke cognitive function and establish their efficacy.

Methods and analysis: A systematic review of non-randomised controlled studies that investigated the efficacy of psychological interventions aimed at improving cognitive function in stroke survivors will be conducted. Electronic searches will be performed in the Pubmed, EMBASE, and PsycINFO databases, the search dating from the beginning of the index to February 2017. Reference lists of all identified relevant articles will be reviewed to identify additional studies not previously identified by the electronic search. Potential grey literature will be reviewed using Google Scholar. Titles and abstracts will be assessed for eligibility by one reviewer, with a random sample of 50% independently double-screened by second reviewers. Any discrepancies will be resolved through discussion, with referral to a third reviewer where necessary. Risk of bias will be assessed with the ROBINS-I tool. Meta-analyses will be performed if studies are sufficiently homogeneous. This review will follow the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) statement. The quality of the evidence regarding cognitive function will be assessed according to the Grading of Recommendations Assessment, Development and Evaluation (GRADE).

Ethics and Dissemination: This systematic review will collect secondary data only and as such ethical approval is not required. Findings will be disseminated through presentations and peer-reviewed publication. This review will provide information on the effectiveness of psychological interventions for post-stroke cognitive impairment, identifying which psychological interventions are effective for improving post-stroke cognitive function.

PROSPERO Registration Number: CRD42017069714.

WC: 2,709

Keywords

Stroke; cognitive impairment; cognitive rehabilitation

Strengths and Limitations

- This systematic review protocol will be reported in accordance with the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) statement.
- Three databases covering the medical and psychological peer-reviewed literature will be searched.
- The quality of the evidence will be assessed based on the Grading of Recommendations Assessment, Development and Evaluation (GRADE).
- This systematic review will not include interventions based on pharmacological or non-psychological treatments, and will include stroke patients only.

Introduction

Stroke is one of the primary causes of death and disability worldwide (1), with a considerable proportion of those having a stroke developing significant persistent cognitive deficits which impact upon functional ability (2). Cognitive impairment has been reported in over half of patients six months post-stroke, and is associated with increased disability and a poorer quality of life (3), while cognitive impairment in the acute phase post-stroke is associated with depressive symptoms in the longer-term (4). Those with moderate post-stroke cognitive impairment are six times more likely to transition to incident dementia compared to those without cognitive impairment (5), with up to a quarter of patients with cognitive impairment diagnosed with dementia in the 3 years following stroke (6). Furthermore, it has been shown that 10% of patients develop dementia following a first ever stroke and over one third develop dementia following a recurrent stroke (7). As such, there is a strong association between cognitive impairment and nursing home admission, particularly in those individuals affected by a more severe stroke. While the recovery of physical function post-stroke has been the main focus of rehabilitation and research, with evidence demonstrating significant improvements following physical rehabilitation (8,9), rehabilitation of post-stroke cognitive impairment has received considerably less attention. Despite the prevalence of cognitive impairment post-stroke, and the associated implications for stroke survivors and burden on carers and the healthcare system, the efficacy of existing psychological interventions for the rehabilitation of cognitive impairment following stroke has yet to be established.

Cognitive rehabilitation has been defined as a "systematic, functionally oriented service of therapeutic activities that is based on assessment and understanding of the patient's brain-behavioural deficits" (10). Five previous Cochrane reviews have been conducted in the area of post-stroke cognitive rehabilitation. Specifically, these reviews have focused on occupational therapy for cognitive impairment (11), memory deficits (12), executive dysfunction (13), spatial neglect (14), and attention deficits (15) following stroke. Each has concluded that the effectiveness of cognitive rehabilitation aimed at each of these domains separately has yet to be established. However, the stringent nature of eligibility criteria for inclusion in these reviews could have resulted in the exclusion of important non-randomised controlled studies. The pattern of post-stroke cognitive impairment suggests that deficits may be evident across all cognitive domains rather than being confined to one cognitive domain (16,17), with lesion location predicting the severity of cognitive impairment across different cognitive domains following stroke (18,19). Despite the evidence suggesting more diffuse cognitive impairment

post-stroke rather than domain-specific deficits, there is, as yet, no review of psychological interventions for post-stroke cognitive impairment that includes the full range of psychological interventions and which targets all forms of cognitive impairment (e.g., including memory, attention, executive function, etc.). While a Cochrane review of randomised controlled trials of psychological interventions for post-stroke cognitive impairment is now planned by our group (20), this current review aims to capture those non-randomised controlled studies which do not meet the strict inclusion criteria of a Cochrane review but may be of value when designing a cognitive rehabilitation programme for post-stroke cognitive impairment.

Therefore the aims of the present systematic review are to identify which types of (non-randomised) psychological interventions have been employed to improve cognitive function post-stroke and to assess the efficacy of these interventions in stroke survivors. The overarching goal is to inform the development of a cognitive rehabilitation intervention for individuals who experience cognitive impairment following stroke.

Methods and Analyses

Study Design

This systematic review protocol will be reported in accordance with the Preferred Reporting Items for Systematic review and Meta-analysis Protocols (PRISMA-P) (21,22). Results will be reported in line with the Preferred Reporting Items for Systematic review and Meta-analysis (PRISMA) statement (23,24).

Study Registration

In accordance with the PRISMA-P guidelines, this systematic review protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO) on 30 June 2017 (registration number: CRD42017069714; http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42017069714)

Eligibility Criteria

Types of study

All non-randomised controlled studies and quasi-randomised controlled trials examining psychological interventions to improve cognitive function following stroke will be included in this systematic review, including feasibility studies, pilot studies, experimental studies, and quasi-experimental studies. RCTs, review articles, letters, editorials, qualitative studies, case studies, animal studies and study protocols will be excluded.

Participants

Studies of an adult population (age 18+) will be included. Studies of participants with mixed aetiologies (e.g., traumatic brain injury/stroke mix) will be excluded unless data are available, or made available upon contacting the study authors, for those participants with a primary diagnosis of stroke (ischaemic, intracranial haemorrhagic, subarachnoid haemorrhage) or if the study has more than 75% of people with stroke in their sample (15).

Types of interventions

Given the wide variation in types of interventions to address post-stroke cognitive impairment, psychological interventions of any type and duration intended to rehabilitate cognition post-stroke will be included. Examples of the eligible interventions will include: neuropsychological

interventions; patient education interventions (video, books, leaflets, posters, videos, interactive modules); electronic interventions (e.g., use of iPads, tablets); mobile phone apps, including brain training apps/games; cognitive and/or behavioural interventions, including problem-solving; strategy training (e.g. errorless learning, mnemonic strategies, vanishing cues); goal management training; self-efficacy training. Studies with pharmacological or other non-psychological interventions will be excluded.

Comparisons or control

Studies addressing psychological interventions to improve cognition following stroke in comparison to a usual/routine care control arm or an active control arm will be included.

Outcome measures

The outcome of interest is improved cognition after stroke, using a validated measure of domain specific cognitive function, including those comprising the NINDS 30-minute or 60-minute battery of cognitive assessment (25). As a number of studies report scores from cognitive screening tools such as the Montreal Cognitive Assessment (MoCA) (26), Mini-Mental State Examination (MMSE) (27), and Abbreviated Mental Test (AMT) (28), these validated measures of cognition will also be acceptable. Other validated measures of domain specific cognitive function are also acceptable, as are validated measures of subjective cognitive function (e.g. Cognitive Failures Questionnaire (29); Metamemory in Adulthood Questionnaire (30)) and Goal Attainment Scaling (31).

Secondary outcomes of interest include reports of functional abilities in daily life and quality of life, including activities of daily living (ADL), for example using the modified Rankin Scale (mRS) (32); Instrumental activities of daily living (IADL), for example using the Nottingham Extended Activities of Daily Living (NEADL) scale (33); Quality of life (QoL), based on stroke-specific or generic QoL assessment measures; subsequent incidence of recurrent stroke, dementia, cardiovascular events, or all-cause mortality.

Search strategy for the identification of relevant studies

The search strategy has been developed in collaboration with a subject librarian. Three databases covering the medical and psychological peer-reviewed literature will be searched: Pubmed (http://www.ncbi.nlm.nih.gov/pubmed/), EMBASE (https://www.embase.com) and PsycINFO (http://www.apa.org/pubs/databases/psycinfo/index.aspx). The Pubmed search

strategy is detailed in Appendix 1. These terms will also be mapped to Medical Subject Headings (MeSH) terms, and similar terms in EMBASE and PsycINFO, the search dating from the beginning of the index to February 2017. The search will be restricted to articles published in English.

Searches will be exported to EndNote X7™ to build a master file of all references. In addition to the database searches, the reference list of included articles will be reviewed for relevant studies. A citation search will also be carried out to identify papers citing included articles, using Web of Science. A hand-search will also be conducted of the four journals that generate the greatest number of relevant articles.

Screening of the Studies

Duplicates will be identified using EndNote X7™ 'find duplicates' function. Titles and abstracts will be assessed for eligibility by one reviewer (NAM). Depending on the volume of papers generated by the search, at least a random 50% will be independently double-screened between four second reviewers (MEW, IJ, AG, DR). The full texts of papers identified as potentially eligible will be obtained for independent review by two reviewers. Any differences between reviewers will be resolved through discussion, with reference to a third independent reviewer (AH) where necessary.

Data Extraction

Data from included studies will be extracted using a standardised, pre-piloted data extraction form. Two reviewers will extract data independently, with discrepancies identified and resolved through discussion, including with a third author where necessary. Extracted information will include: authors, study design, sample size (baseline and follow-up), sample description, target population characteristics, intervention type, intervention content, control (placebo, no treatment), length of follow-up, type of outcome, primary and secondary outcomes (listed above), comments, and study conclusions. Study authors will be contacted for missing data or further information if necessary.

Risk of bias

Two authors will assess the strengths and weaknesses of each eligible study using the Risk Of Bias In Non-randomized Studies - of Interventions (ROBINS-I) tool by the Cochrane Collaboration (34).

No study will be excluded as a result of findings from the risk of bias assessments. However, if substantial variation in risk of bias of included studies is found, results will be synthesised separately for studies at high risk and low risk of bias.

Quality of evidence

The quality of the evidence of the studies will be assessed by two reviewers (NAM and MEW) based on the Grading of Recommendations Assessment, Development and Evaluation (GRADE) (35). The quality of the studies will be judged as high (further research is very unlikely to change the confidence in the effect estimates), moderate (further research is likely to have an important impact on the confidence in the effect and may change the estimate), low (further research is very likely to have an important impact on the confidence in the effect and is likely to change the estimate) and very low (any estimate of the effect is very uncertain) (35)

Strategy for data synthesis

Meta-analysis will be conducted provided that the studies/methods are sufficiently homogeneous regarding the interventions and outcomes and, if sufficient data are available, to synthesise the direction, size and consistency of the possible effects, using Stata version 14. Where there are no established thresholds for meaningful change for a given measure, the effect size thresholds suggested by Cohen (36) will be used - 'trivial' (ES<0.20), 'small' (ES≥0.20<0.50), 'moderate' (ES≥0.50<0.80), or large (ES≥0.80). Where necessary and possible, effect sizes will be adjusted to account for the correlation between baseline and outcome measures, as outlined by Middel and van Sonderen (2002) (37). If meta-analysis is not possible due to substantial heterogeneity, etc., a narrative synthesis of the findings from the included studies will be provided, structured around the type of intervention, target population characteristics, type of outcome and intervention content. Heterogeneity will be quantified using the I-squared statistic.

Analyses of subgroup or subsets

If sufficient data are available, subgroup analyses will be conducted. These analyses will assess differences between age of participants with stroke (<65 versus >=65); impact of depression and/or fatigue on cognitive performance; objective versus subjective improvement in cognition; type of intervention (e.g., self-efficacy training versus education versus electronic; brief versus intensive; group versus individual; brief health care professional (HCP) contact versus longer-

term HCP contact, etc.), duration, and delivery of intervention, timing of outcome measures (e.g., direct versus late effects of the intervention); quality and risk of bias.

Discussion

To the best of our knowledge, this review will be the first to investigate non-randomised controlled studies of the effectiveness of psychological interventions aimed at improving general cognitive function post-stroke. Previous reviews have examined domain-specific interventions and outcomes such as attention, memory, executive function, and spatial neglect, with each review concluding that effectiveness of cognitive rehabilitation aimed at each of these domains separately has yet to be established (12–15). However the pattern of post-stroke cognitive impairment typically is diffuse in nature, affecting a number of cognitive domains (16,17). Furthermore, due to the stringent eligibility criteria of previous reviews important studies may not have been included. These factors may limit the interpretation of the findings regarding the impact of interventions aimed at improving cognitive function in stroke survivors. Considering that cognitive impairment is a risk factor for progression to dementia, particularly in the context of further stroke (7), it is important to investigate the effectiveness of different types of psychological interventions to improve cognitive function in those with post-stroke cognitive impairment.

The results of this review will provide evidence regarding which types, duration, and delivery of psychological interventions are effective for managing post-stroke cognitive impairment, and will, in turn, inform the development of a cognitive rehabilitation programme as part of a wider study, the StrokeCog study (38), aimed at improving cognitive function post-stroke. Furthermore, if sufficiently homogenous data are available to conduct a meta-analysis, healthcare professionals will have information available regarding the expected effect size associated with a given intervention. This information will be useful for planning of rehabilitation services for those with post-stroke cognitive impairment.

Ethics and Dissemination

We did not seek formal ethical approval for this study as primary data will not be collected. The results from this systematic review will be disseminated by scientific publication and presentations at scientific events.

Contributors

NAM, ES, ND, GMC, NP, DR, IJ, AG, MEW, DW, FD, FH, MW, KEB, and AH contributed to the conception and design of the study, the development of the search strategy, the establishment of the inclusion and exclusion criteria, data extraction criteria, analyses and interpretation. NAM, DR, IJ, AG, and MEW will perform the study search, screening and extraction of data. NAM drafted the manuscript, and AH, KEB, DW, NP, FH, and FD provided critical revision of the paper. All authors read and approved the final manuscript.

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Competing interests

None declared.

Protocol amendments

Protocol amendments will be documented with the date of each amendment and with a description of the change and the rationale.

Data sharing statement

We, authors, agree that, should the article be accepted, the BMJ Open shall take over the authors' rights relating to this article, which shall become the property of the Journal.

References

1. Feigin VL, Norrving B, Mensah GA. Global burden of stroke. Circ Res. 2017;120(3):439–48.

2. Tatemichi TK, Desmond DW, Stern Y, Paik M, Sano M, Bagiella E. Cognitive impairment after stroke: Frequency, patterns, and relationship to functional abilities. J Neurol Neurosurg Psychiatry [Internet]. 1994;57(2):202–7. Available from: http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=8126506

3. Mellon L, Brewer L, Hall P, Horgan F, Williams D, Hickey A. Cognitive impairment six months after ischaemic stroke: A profile from the ASPIRE-S study. BMC Neurol [Internet]. 2015;15(31):1–9. Available from: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4359388&tool=pmcentrez&rendertype=abstract

4. Nys GMS, van Zandvoort MJE, van der Worp HB, de Haan EHF, de Kort PLM, Jansen BPW, et al. Early cognitive impairment predicts long-term depressive symptoms and quality of life after stroke. J Neurol Sci. 2006;247(2):149–56.

5. Narasimhalu K, Ang S, De Silva DA, Wong M-C, Chang H-M, Chia K-S, et al. Severity of CIND and MCI predict incidence of dementia in an ischemic stroke cohort. Neurology. 2009;73(22):1866–72.

6. Sachdev PS, Chen X, Brodaty H, Thompson C, Altendorf A, Wen W. The determinants and longitudinal course of post-stroke mild cognitive impairment. J Int Neuropsychol Soc [Internet]. 2009;15(6):915–23. Available from: http://www.ncbi.nlm.nih.gov/pubmed/19891821

7. Pendlebury ST, Rothwell PM. Prevalence, incidence, and factors associated with pre-stroke and post-stroke dementia: A systematic review and meta-analysis. Lancet Neurol [Internet]. 2009;8(11):1006–18. Available from: http://dx.doi.org/10.1016/S1474-4422(09)70236-4

8. Horgan F, Hickey A, McGee H, O'Neill D. National Audit of Stroke Care [Internet]. Dublin, Ireland; 2008. Available from: http://epubs.rcsi.ie/psycholrep/17/

9. Saka Ö, McGuire A, Wolfe C. Cost of stroke in the United Kingdom. Age Ageing. 2009;38(1):27–32.

10. Cicerone KD, Dahlberg C, Malec JF, Langenbahn DM, Felicetti T, Kneipp S, et al. Evidence-based cognitive rehabilitation: Updated review of the literature from 1998 through 2002. Arch Phys Med Rehabil. 2005;86(8):1681–92.

11. Hoffmann T, Bennett S, Koh C-L, McKenna KT. Occupational therapy for cognitive impairment in stroke patients. Cochrane Database Syst Rev. 2010;(9):CD006430.

12. das Nair R, Cogger H, Worthington E, Lincoln NB. Cognitive rehabilitation for memory deficits following stroke. Cochrane Database Syst Rev. 2016;9:CD002293.

13. Chung CSY, Pollock A, Campbell T, Durward BR, Hagen S. Cognitive rehabilitation for executive dysfunction in patients with stroke or other adult non-progressive acquired brain damage. Cochrane Database Syst Rev. 2013;(4):CD008391.

14. Bowen A, Hazelton C, Pollock A, Lincoln NB. Cognitive rehabilitation for spatial neglect following stroke. Cochrane Database Syst Rev [Internet]. 2013;(7):CD003586. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23813503

15. Loetscher T, Lincoln NB. Cognitive rehabilitation for attention deficits following stroke. Cochrane Database Syst Rev [Internet]. 2013;(5):CD002842. Available from: http://onlinelibrary.wiley.com/store/10.1002/14651858.CD002842.pub2/asset/CD002842.pdf?v=1&t=icp2f4j9&s=4202599389d6199b9e52dc776db5c2a03c617ecd

16. Sachdev PS, Brodaty H, Valenzuela MJ, Lorentz L, Looi JCL, Wen W, et al. The neuropsychological profile of vascular cognitive impairment in stroke and TIA patients. Neurology. 2004;62:912–9.

17. Vasquez BP, Zakzanis KK. The neuropsychological profile of vascular cognitive impairment not demented: A meta-analysis. J Neuropsychol. 2015;9(1):109–36.

18. Barker-Collo S, Starkey N, Lawes CMM, Feigin V, Senior H, Parag V. Neuropsychological profiles of 5-year ischemic stroke survivors by oxfordshire stroke classification and hemisphere of lesion. Stroke. 2012;43(1):50–5.

19. Nys GMS, Van Zandvoort MJE, De Kort PLM, Jansen BPW, Van Der Worp HB, Kappelle LJ, et al. Domain-specific cognitive recovery after first-ever stroke: A follow-up study of

111 cases. J Int Neuropsychol Soc [Internet]. 2005;11(7):795–806. Available from: http://www.researchgate.net/publication/7259366_Domain-specific_cognitive_recovery_after_first-ever_stroke_A_follow-up_study_of_111_cases

20. Hickey A, Merriman NA, McCabe G, Mellon L, Bennett KE, Pender N, et al. Psychological interventions for managing cognitive impairment after ischaemic stroke [Internet]. Available from: http://www.cochrane.org/title/psychological-interventions-managing-cognitive-impairment-after-ischaemic-stroke

21. Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. Syst Rev [Internet]. 2015;4(1):1. Available from: http://systematicreviewsjournal.biomedcentral.com/articles/10.1186/2046-4053-4-1

22. Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. Syst Rev [Internet]. 2016;354:i4086. Available from: http://systematicreviewsjournal.biomedcentral.com/articles/10.1186/2046-4053-4-1

23. Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. Annu Intern Med. 2009;151(4):264–9.

24. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, Ioannidis JPA, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. PLoS Med. 2009;6(7):e1000100.

25. Hachinski V, Iadecola C, Petersen RC, Breteler MM, Nyenhuis DL, Black SE, et al. National Institute of Neurological Disorders and Stroke-Canadian Stroke Network vascular cognitive impairment harmonization standards. Stroke. 2006;37(9):2220–41.

26. Nasreddine ZS, Phillips NA, Bédirian V, Charbonneau S, Whitehead V, Collin I, et al. The Montreal Cognitive Assessment, MoCA: a brief screening tool for mild cognitive impairment. J Am Geriatr Soc [Internet]. 2005 [cited 2013 Jun 25];53(4):695–9. Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1532-5415.2005.53221.x/full

27. Folstein MF, Folstein SE, McHugh PR. Mini-Mental State: A practical method for grading

the cognitive state of patients for the clinician. J Psychiatr Res. 1975;12(3):189–98.

28. Hodkinson HM. Evaluation of a mental test score for assessment of mental impairment in the elderly. Age Ageing. 1972;1:233–8.

29. Broadbent DE, Cooper PF, FitzGerald P, Parkes KR. The Cognitive Failures Questionnaire (CFQ) and its correlates. Br J Clin Psychol [Internet]. 1982;21(1):1–16. Available from: http://doi.wiley.com/10.1111/j.2044-8260.1982.tb01421.x

30. Dixon RA, Hultsch DF, Hertzog C. The Metamemory in Adulthood (MIA) questionnaire. Psychopharmacol Bull [Internet]. 1989;25(2):157. Available from: www-ncbi-nlm-nih-gov.elib.tcd.ie/pubmed/3249770

31. Kiresuk TJ, Sherman RE. Goal attainment scaling: A general method for evaluating comprehensive community mental health programs. Community Ment Health J. 1968;4(6):443–53.

32. Sulter G, Steen C, De Keyser J. Use of the Barthel index and modified Rankin scale in acute stroke trials. Stroke. 1999;30:1538–41.

33. Nouri FM, Lincoln NB. An extended activities of daily living scale for stroke patients. Clin Rehabil. 1987;1(4):301–5.

34. Sterne JAC, Hernán MA, Reeves BC, Savović J, Berkman ND, Viswanathan M, et al. ROBINS-I: a tool for assessing risk of bias in non-randomized studies of interventions. BMJ. 2016;355:i4919.

35. Guyatt GH, Oxman AD, Vist GE, Kunz R, Falck-Ytter Y, Alonso-Coello P, et al. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. Br Med J. 2008;336(April):924–6.

36. Cohen J. Statistical power analysis for the behavioural sciences. rev. ed. New York, NY: Academic Press; 1977.

37. Middel B, Van Sonderen E. Statistical significant change versus relevant or important change in (quasi) experimental design: Some conceptual and methodological problems in estimating magnitude of intervention-related change in health services research. Int J Integr Care [Internet]. 2002;2(4). Available from: http://www.ijic.org/article/10.5334/ijic.65/

38. The StrokeCog study: modelling and modifying the consequences of stroke-related cognitive impairment through intervention [Internet]. Available from: http://www.hrb.ie/research-strategy-funding/grants-and-fellowships/funding-awarded/funding-award/awards//639/

Appendix 1: Pubmed search strategy

((((stroke[MeSH] OR intracranial embolism and thrombosis[MeSH] OR intracranial arteriosclerosis[MeSH] OR dementia, vascular[MeSH] OR cerebrovascular disorders[MeSH:noexp] OR basal ganglia cerebrovascular disease[MeSH] OR brain ischemia[MeSH] OR carotid artery diseases[MeSH] OR cerebral small vessel disease[MeSH] OR brain injuries[MeSH]) OR (stroke[Title/Abstract] OR cerebrovascular[Title/Abstract] OR post stroke[Title/Abstract] OR poststroke[Title/Abstract] OR cerebral ischaemia*[Title/Abstract] OR cerebral ischemia*[Title/Abstract] OR brain ischaemia*[Title/Abstract] OR brain ischemia*[Title/Abstract] OR ischemic attack*[Title/Abstract] OR ischaemic attack*[Title/Abstract] OR ischemic event*[Title/Abstract] OR ischaemic event*[Title/Abstract] OR cerebral infarct*[Title/Abstract] OR brain infarct*[Title/Abstract] OR cva[Title/Abstract] OR cerebral vascular[Title/Abstract] OR brain injur*[Title/Abstract]) OR ((cerebral[Title/Abstract] OR cerebellar[Title/Abstract] OR brain*[Title/Abstract] OR vertebrobasilar[Title/Abstract]) AND (infarct*[Title/Abstract] OR ischemi*[Title/Abstract] OR ischaemi*[Title/Abstract] OR thrombo*[Title/Abstract] OR emboli*[Title/Abstract] OR apoplexy[Title/Abstract]))) AND ((cognition disorders[MeSH:noexp] OR neurobehavioral manifestations[MeSH:noexp] OR confusion[MeSH:noexp] OR memory disorders[MeSH:noexp] OR mental processes[MeSH:noexp] OR cognition[MeSH:noexp] OR comprehension[MeSH:noexp] OR learning[MeSH:noexp] OR generalization psychology[MeSH:noexp] OR transfer psychology[MeSH:noexp] OR perception[MeSH:noexp] OR thinking[MeSH:noexp] OR concept formation[MeSH:noexp] OR judgment[MeSH:noexp] OR problem solving[MeSH:noexp] OR perceptual disorders[MeSH:noexp] OR arousal[MeSH:noexp] OR orientation[MeSH:noexp] OR attention[MeSH:noexp] OR awareness[MeSH:noexp] OR memory[MeSH:noexp] OR recognition psychology[MeSH:noexp] OR algorithms[MeSH:noexp] OR impulsive behavior[MeSH:noexp] OR neuropsychological tests[MeSH:noexp] OR metacognition[MeSH:noexp]) OR (agnosia[Title/Abstract] OR amnesia[Title/Abstract] OR confusion[Title/Abstract] OR inattention[Title/Abstract]) OR ((cognit*[Title/Abstract] OR arous*[Title/Abstract] OR orientat*[Title/Abstract] OR attention*[Title/Abstract] OR concentrat*[Title/Abstract] OR memor*[Title/Abstract] OR recall[Title/Abstract] OR percept*[Title/Abstract] OR think*[Title/Abstract] OR sequenc*[Title/Abstract] OR algorithm*[Title/Abstract] OR judgement*[Title/Abstract] OR judgment*[Title/Abstract] OR awareness[Title/Abstract] OR problem solving[Title/Abstract] OR generalisation[Title/Abstract] OR generalization[Title/Abstract] OR transfer[Title/Abstract] OR comprehension[Title/Abstract] OR learning[Title/Abstract]) AND (disorder*[Title/Abstract] OR declin*[Title/Abstract] OR dysfunct*[Title/Abstract] OR impair*[Title/Abstract] OR deficit*[Title/Abstract] OR abilit*[Title/Abstract] OR problem*[Title/Abstract])) OR (concept[Title/Abstract] AND formation[Title/Abstract]) OR (dysexecutive syndrome*[Title/Abstract] OR dysexecutive function[Title/Abstract] OR mental process*[Title/Abstract] OR impulsive behavior*[Title/Abstract] OR impulsive behaviour*[Title/Abstract] OR executive function[Title/Abstract] OR executive dysfunction[Title/Abstract] OR front striatal dysfunction[Title/Abstract]))) AND ((Rehabilitation[MeSH] OR games, experimental[MeSH] OR Computer-Assisted Instruction[MeSH]) OR (cognitive intervention*[Title/Abstract] OR cognitive training[Title/Abstract] OR cognitive rehabilitation[Title/Abstract] OR cognitive

stimulation[Title/Abstract] OR psychological intervention*[Title/Abstract] OR psychological rehabilitation[Title/Abstract] OR psychological training[Title/Abstract] OR cognitive program*[Title/Abstract] OR psychological program*[Title/Abstract] OR training program*[Title/Abstract] OR neuropsychologic*[Title/Abstract] OR computer* AND training[Title/Abstract] OR video game*[Title/Abstract] OR computer game*[Title/Abstract] OR brain training[Title/Abstract] OR memory training[Title/Abstract] OR mnemonic training[Title/Abstract] OR cognitive remediation[Title/Abstract] OR cognitive enhancement[Title/Abstract] OR neurological outcome measure*[Title/Abstract] OR Goal Attainment Scaling[Title/Abstract] OR mental practice[Title/Abstract] OR mental imagery[Title/Abstract] OR visual scanning training[Title/Abstract] OR compensat*[Title/Abstract])))) NOT (((((stroke[MeSH] OR intracranial embolism and thrombosis[MeSH] OR intracranial arteriosclerosis[MeSH] OR dementia, vascular[MeSH] OR cerebrovascular disorders[MeSH:noexp] OR basal ganglia cerebrovascular disease[MeSH] OR brain ischemia[MeSH] OR carotid artery diseases[MeSH] OR cerebral small vessel disease[MeSH] OR brain injuries[MeSH]) OR (stroke[Title/Abstract] OR cerebrovascular[Title/Abstract] OR post stroke[Title/Abstract] OR poststroke[Title/Abstract] OR cerebral ischaemia*[Title/Abstract] OR cerebral ischemia*[Title/Abstract] OR brain ischaemia*[Title/Abstract] OR brain ischemia*[Title/Abstract] OR ischemic attack*[Title/Abstract] OR ischaemic attack*[Title/Abstract] OR ischemic event*[Title/Abstract] OR ischaemic event*[Title/Abstract] OR cerebral infarct*[Title/Abstract] OR brain infarct*[Title/Abstract] OR cva[Title/Abstract] OR cerebral vascular[Title/Abstract] OR brain injur*[Title/Abstract]) OR ((cerebral[Title/Abstract] OR cerebellar[Title/Abstract] OR brain*[Title/Abstract] OR vertebrobasilar[Title/Abstract]) AND (infarct*[Title/Abstract] OR ischemi*[Title/Abstract] OR ischaemi*[Title/Abstract] OR thrombo*[Title/Abstract] OR emboli*[Title/Abstract] OR apoplexy[Title/Abstract])))) AND ((cognition disorders[MeSH:noexp] OR neurobehavioral manifestations[MeSH:noexp] OR confusion[MeSH:noexp] OR memory disorders[MeSH:noexp] OR mental processes[MeSH:noexp] OR cognition[MeSH:noexp] OR comprehension[MeSH:noexp] OR learning[MeSH:noexp] OR generalization psychology[MeSH:noexp] OR transfer psychology[MeSH:noexp] OR perception[MeSH:noexp] OR thinking[MeSH:noexp] OR concept formation[MeSH:noexp] OR judgment[MeSH:noexp] OR problem solving[MeSH:noexp] OR perceptual disorders[MeSH:noexp] OR arousal[MeSH:noexp] OR orientation[MeSH:noexp] OR attention[MeSH:noexp] OR awareness[MeSH:noexp] OR memory[MeSH:noexp] OR recognition psychology[MeSH:noexp] OR algorithms[MeSH:noexp] OR impulsive behavior[MeSH:noexp] OR neuropsychological tests[MeSH:noexp] OR metacognition[MeSH:noexp]) OR (agnosia[Title/Abstract] OR amnesia[Title/Abstract] OR confusion[Title/Abstract] OR inattention[Title/Abstract]) OR ((cognit*[Title/Abstract] OR arous*[Title/Abstract] OR orientat*[Title/Abstract] OR attention*[Title/Abstract] OR concentrat*[Title/Abstract] OR memor*[Title/Abstract] OR recall[Title/Abstract] OR percept*[Title/Abstract] OR think*[Title/Abstract] OR sequenc*[Title/Abstract] OR algorithm*[Title/Abstract] OR judgement*[Title/Abstract] OR judgment*[Title/Abstract] OR awareness[Title/Abstract] OR problem solving[Title/Abstract] OR generalisation[Title/Abstract] OR generalization[Title/Abstract] OR transfer[Title/Abstract] OR comprehension[Title/Abstract] OR learning[Title/Abstract]) AND (disorder*[Title/Abstract] OR declin*[Title/Abstract] OR dysfunct*[Title/Abstract] OR impair*[Title/Abstract] OR deficit*[Title/Abstract] OR

abilit*[Title/Abstract] OR problem*[Title/Abstract])) OR (concept[Title/Abstract] AND formation[Title/Abstract]) OR (dysexecutive syndrome*[Title/Abstract] OR dysexecutive function[Title/Abstract] OR mental process*[Title/Abstract] OR impulsive behavior*[Title/Abstract] OR impulsive behaviour*[Title/Abstract] OR executive function[Title/Abstract] OR executive dysfunction[Title/Abstract] OR front striatal dysfunction[Title/Abstract]))) AND ((Rehabilitation[MeSH] OR games, experimental[MeSH] OR Computer-Assisted Instruction[MeSH]) OR (cognitive intervention*[Title/Abstract] OR cognitive training[Title/Abstract] OR cognitive rehabilitation[Title/Abstract] OR cognitive stimulation[Title/Abstract] OR psychological intervention*[Title/Abstract] OR psychological rehabilitation[Title/Abstract] OR psychological training[Title/Abstract] OR cognitive program*[Title/Abstract] OR psychological program*[Title/Abstract] OR training program*[Title/Abstract] OR neuropsychologic*[Title/Abstract] OR computer* AND training[Title/Abstract] OR video game*[Title/Abstract] OR computer game*[Title/Abstract] OR brain training[Title/Abstract] OR memory training[Title/Abstract] OR mnemonic training[Title/Abstract] OR cognitive remediation[Title/Abstract] OR cognitive enhancement[Title/Abstract] OR neurological outcome measure*[Title/Abstract] OR Goal Attainment Scaling[Title/Abstract] OR mental practice[Title/Abstract] OR mental imagery[Title/Abstract] OR visual scanning training[Title/Abstract] OR compensat*[Title/Abstract]))) AND (randomized controlled trial[Publication Type] OR controlled clinical trial[Publication Type] OR randomized[Title/Abstract] OR randomised[Title/Abstract] OR placebo[Title/Abstract] OR clinical trials as topic[MeSH:noexp] OR randomly[Title/Abstract] OR trial[Title]))

Managing cognitive impairment following stroke: Protocol for a systematic review of non-randomised controlled studies of psychological interventions.

PRISMA-P 2015 Checklist: recommended items to include in a systematic review protocol

Section and topic	Item Number	Checklist item	Page number(s)
ADMINISTRATIVE INFORMATION			
Title: Managing cognitive impairment following stroke: Protocol for a systematic review of non-randomised controlled studies of psychological interventions.			
Identification	1a	Identify the report as a protocol of a systematic review	1
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	Not an update
Registration	2	If registered, provide the name of the register (such as PROSPERO) and registration number	2
Authors:			
Contact	3a	Provide name, institutional affiliation, email address of all protocol authors; provide physical mailing address of corresponding author	1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	12
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	Not an amendment
Support:			
Sources	5a	Indicate sources of financial or other support for the review	12
Sponsor	5b	Provide name for the review funder and/or sponsor	12
Role of sponsor or funder	5c	Describe role of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	12
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	4-5
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants,	5

Managing cognitive impairment following stroke: Protocol for a systematic review of non-randomised controlled studies of psychological interventions.

		interventions, comparators, and outcomes (PICO)	
METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	6-7
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trials registers or other grey literature sources) with planned dates of coverage	7
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated.	Appendix 1
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	8
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis	8
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	8
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding source), any pre-planned data assumptions and simplifications	6-7
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	7
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level., or both; state how this	8-9

Managing cognitive impairment following stroke: Protocol for a systematic review of non-randomised controlled studies of psychological interventions.

		information will be used in data synthesis	
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	9
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I2, Kendall's)	9
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	9-10
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	9
Met-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	8-9
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assesses (such as GRADE)	9